

Things to Know, Understand and Do For Chapter 4: Electronic Structure

By the end of Chapter 4, you should

Know how to...
Use the terms, <i>wavelength, frequency, speed</i> of waves
Use equation $c=\lambda\nu$, the relationship between wavelength (λ) and frequency (ν) of electromagnetic radiation and the speed of light (c)
Recognize the relative wavelength or frequency of various types of electromagnetic radiation.
Understand that the energy of a photon, a massless particle of radiation, is proportional to its frequency ($E = h\nu$). This is an extension of Planck's idea that energy at the atomic level is quantized
Describe origin of light from excited atoms, its relationship to atomic structure and how Bohr's atomic model accounts for the emission line spectra of excited hydrogen and why it does not work in an atom with 2 or more electrons.
Understand that, in the Bohr model of the H atom, the electron can occupy only certain energy levels. Also how electrons can jump from energy level to energy level, absorbing and releasing energy.
Describe experimental evidence for and concept of particle-wave duality.
Recognize significance of quantum mechanical model of atomic structure.
Define three of the four quantum numbers (<i>n, l, m_s</i>) and their relationship to atomic structure.
Describe the shapes of the s, p, and d orbitals and identify the types that exist
Classify substances as paramagnetic (attracted to a magnetic field; characterized by unpaired electron spin(s)) or diamagnetic (repelled by a magnetic field; characterized by all electrons being paired)
Write the electron configurations, orbital notations, electron dot notations (full and shorthand) for atoms in their ground and excited states as well as monatomic ions.
Using the periodic table as a guide, write electron configurations and draw orbital energy diagrams, recognizing paired and unpaired electrons.
Write the electron configurations for Cr and Cu (and other members of their families), exceptions in electron filling order.
Recognize the electrons are assigned to subshells of an atom in order of increasing subshell energy in many electron atoms. (the ns orbital fills before the (n-1)d orbital.)
When assigning electrons to atomic orbitals, apply the Aufbau principle, Hund's rule, and the Pauli exclusion principle.

understand...
Rutherford's model of the atom and the two reasons why it was wrong.
Planck's work with heating metals, his findings, and how energy comes in discrete amounts (quanta).
Photoelectric Effect and how only light with a certain minimum frequency can eject an electron from an atom.
Bohr's model of the hydrogen atom, and how he was right and wrong
deBroglie's X-ray diffraction experiment and how it showed wave-particle duality
How the quantum model is similar and different than Bohr's model
Heisenberg's Uncertainty Principle
Understand how an orbital for an electron in an atom corresponds to both the allowed energy of that electron.
Understand that the position of an electron is not known with certainty (Heisenberg Uncertainty Principle); only the probability of an electron being at a given point in space can be calculated (this is the orbital in which it may be located)
That the Pauli exclusion principle leads to the conclusion that no atomic orbital has been assigned more than two electrons and that the two electrons in an orbital must have opposite spins.

Ch 4 Homework

Read Ch 4

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pg 116 Q 4, 5

pg 118 Q 8, 10

pg 119 Q 23, 24, 30, 32

pg 120 Q 43